

U.S. PATENT APPLICATION  
SERIAL NO.: 10/612,848  
AMENDMENT A

ATTY DOCKET: 3875.023

**REMARKS/ARGUMENTS**

Review and reconsideration of the Office Action dated January 7, 2005, is respectfully requested in view of the above amendments and the following remarks.

Claims 1-12 are pending.

**Office Action**

Turning to the Office Action, the paragraphing of the Examiner is adopted.

**Information Disclosure Statement**

The Examiner has required the filing of an Information Disclosure Statement listing the references cited in the specification.

Applicants are submitting with this amendment an Information Disclosure Statement listing the references cited in the specification.

Accordingly, Applicants respectfully request the Examiner to consider the references listed in the submitted Information Disclosure Statement.

**Oath/Declaration**

The Examiner has indicated that the Oath or Declaration is defective because one of the inventor's signature is missing.

Applicants respectfully submit to the Examiner that no inventor's signature is missing. Applicants submit herewith a copy of the Oath or Declaration in which the allegedly missed inventor's signature is highlighted with a marker. Applicants respectfully submit that the allegedly missed inventor's signature is slightly misplaced and written with very small handwriting.

Therefore, Applicants respectfully request the Examiner to approve the already submitted Oath or Declaration.

#### Drawings

The Examiner has objected to the drawings because a feature described in claim 2 is not shown in the drawings.

Specifically, claim 2 refers to a "single high voltage d-c source", while the specification refers to a "single source" when referring to item 9 in Figure 2 (see paragraph 0020).

Applicants respectfully submit that the specification, in paragraph 0010 describes a "single high voltage d-c source".

Therefore, in response to the Examiner's objection to the drawings, Applicants have amended paragraph 0020 of the specification to refer to a "single high voltage d-c source" with respect to item 9 of Figure 2.

Thus, Applicants respectfully submit that by amending paragraph 0020 of the specification the defect in the drawing has been corrected.

Accordingly, Applicants respectfully request the Examiner to withdraw the objection to the drawings.

#### Specification

The Examiner has not checked the Specification for all possible minor errors. The Examiner points to the guidelines in regards to the preferred layout for the specification.

According to the preferred layout of the specification, Applicants have amended the specification, immediately before paragraph 0017, by deleting the subtitle "**PREFERRED EMBODIMENTS OF THE INVENTION**", and replacing it with the subtitle "**BRIEF DESCRIPTION OF THE DRAWINGS**".

Applicants respectfully submit that the specification, as amended, comply with guidelines regarding the preferred layout for the specification.

#### Claim Objections

The Examiner has renumbered claims 12 and 13 as claims 11 and 12 because these claims were misnumbered.

Applicants acknowledge the renumbering of claims 11 and 12 made by the Examiner.

Accordingly, Applicants, in the listing of the amended claims submitted herewith, have followed the numbering of claims 11 and 12, as applied by the Examiner.

The Examiner has also objected to claim 11 indicating that this claim does not make reference to the volume in terms of range. The Examiner requires proper correction.

In response, Applicants have amended claim 11 to refer to the volume in terms of range.

Therefore, Applicants respectfully request the Examiner to withdraw the objection to claim 11.

**Claims Rejections - 35 U.S.C. § 112**

The Examiner has rejected claims 12 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to point out what is included or excluded by the claim language. The Examiner alleges that claim 12 is an omnibus type claim.

In response, Applicants have amended claim 12 by deleting the recitation "as described in embodiment 1".

Therefore, Applicants respectfully submit that amended claim

12 is not an omnibus claim, because it refers to a specific operating efficiency on TEM<sub>00</sub> mode, defining what is included by the claim language.

Thus, Applicants respectfully submit that claim 12, as amended, is not indefinite under 35 U.S.C. § 112, second paragraph.

Therefore, Applicants respectfully request the Examiner to withdraw the rejection to claim 12 under 35 U.S.C. § 112, second paragraph.

**Claim Rejections - 35 U.S.C. § 103**

The Examiner has rejected claims 1 and 7 under 35 U.S.C. § 103(a) as being allegedly unpatentable over Furuya et al. (U.S. Patent No. 5,293,390) in view of Kyusho (U.S. Patent No. 4,802,185) and Leland et al. (U.S. Patent 4,264,868).

The Examiner alleges that except for 1) the TEA CO<sub>2</sub> laser gas having a mixture of CO<sub>2</sub>, N<sub>2</sub> and optionally, H<sub>2</sub>; and 2) a helium-free TEA CO<sub>2</sub> laser, Furuya et al. discloses all the elements recited in claim 1.

However, the Examiner contends that it is well known in the art for TEA CO<sub>2</sub> to have a gas mixture of CO<sub>2</sub> and N<sub>2</sub>, and He, as described by Kyusho. Furthermore, Examiner alleges that it is well known in the art for TEA CO<sub>2</sub> to provide high power and

short pulses, as described by Cirkel et al. Moreover, the Examiner indicates that Leland et al. teaches a high power laser having a gas mixture of CO<sub>2</sub>, N<sub>2</sub> and Helium-free to obtain nanosecond pulses (short pulses).

Therefore, the examiner asserts that it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the gas mixture of Leland et al. with the laser device of Furuya et al. because it would provide more efficient short pulses without Helium, as disclosed by Leland et al.

With respect to claim 7, the Examiner alleges that Furuya et al. illustrates a profiled electrodes and with rounded edges.

However, the Examiner acknowledges, in page 13 of the Office Action, **that claims 3-6 and 10 are free of prior art** and that these claims would be allowable if rewritten in independent form.

In response, **Applicants have amended claim 1 to incorporate the subject matter of claim 3, which is free of prior art.**

In addition, Applicants respectfully submit that the present invention relates to helium-free transversely excited atmospheric-pressure (TEA) CO<sub>2</sub> laser wherein the operation without helium is achieved by use of simple and inexpensive excitation circuit. Indeed, the principal focus of claim 1 is

the operation of a helium free transversely excited atmospheric pressure CO<sub>2</sub> laser with a pulser that provides means to isolate the spiker and the sustainer discharges and also means to provide controllable delay of the spiker discharge with respect to the pre-ionizing discharge.

Moreover, Applicants respectfully submit that the teaching of Furuya et al. resides in a charging bypass coil (21) which allows charging up the condenser (see Furuya et al. Fig. 1). In fact, In Furuya et al. the bypass coil (21) never appears in the discharge loop and, therefore, can not function as an isolation element.

In contrast, the present invention provides isolation between the spiker and the sustainer discharges by connecting a wire wound inductance between the ground and one of the electrodes. Thus, the spiker discharge, which does not involve inductance, is a short lived, high peak power impulse of low energy discharge (spiker capacitor C<sub>sp</sub> in the present invention is much smaller than the sustainer capacitor C1 and C2, while in Furuya et al., the value of the spiker and sustainer capacitors are equal).

Furthermore, Applicants respectfully submit that the isolation inductance between the spiker and the sustainer provides the means for controlling the sustainer current which is one of the key factors to obtain helium-free operation of the

conventional transversely excited atmospheric pressure CO<sub>2</sub> laser.

Additionally, Applicants respectfully submit, regarding the pre-ionization delay, that the teachings in Furuya et al arise from the fact that the value of pre-ionization capacitors is smaller than that of the main discharge, being an intrinsic property of the circuit which can not be controlled, as the value of the capacitors is decided by the laser load.

In contrast, the present invention resides in an isolation inductance trough which the spiker capacitor is charged and it delays in a **controllable** manner the spiker discharge with respect to the pre-ionizing discharge providing helium free operation of the laser.

With respect to Leland et al., Applicants respectfully submit that this reference teaches a helium-free TEA CO<sub>2</sub> laser operation which is obtained by deluging the inter electrode volume with electrons derived from an extraneous source, such that the creation of high density electrons in the inter-electrode region can lead to helium-free operation.

In the present invention, however, preconditioning of the laser gas mixture is accomplished by producing auxiliary arc discharges between pairs of copper pins placed at regular intervals along the length of the discharge. Thus, in the present invention, helium-free operation is carried in decoupling



of the spiker and sustainer discharges and tailoring of the sustainer pulse by an appropriate inductance, which results in the formation of glow discharge. In fact, the helium-free gas mixture in the inter electrode volume of the present invention is not taught in any of the prior art references cited by the Examiner. Moreover, in the present invention, the inductance plays a very crucial role in controlling the delay between the spiker and sustainer discharges.

Furthermore, in the present invention, the decoupling inductance (the value of which ranges between 0.5 to 6.5 micro Henry) selected for the helium-free operation of a transversely excited CO<sub>2</sub> laser for differential partial pressures of CO<sub>2</sub> gas results in improved electro optical efficiency on the TEM<sub>00</sub> mode, control on the full width half maximum (FWHM), and the peak power of the laser emission. In the present invention, this is achieved irrespective of the electrode shape and geometry, the location and type of preionizer, and for a discharge volume ranging from 1cc to 200cc.

Applicants respectfully submits that Furuya et al. do not teach any provision to introduce electrons in the inter electrode volume from an external source. In fact, the pulser circuit used in Furuya et al. is not compatible to energize an electron beam controlled discharged.

Thus, it is not obvious and not possible for a person

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skilled in the art to practice the present invention by combining Leland et al. gas mixture and Furuya et al. excitation circuit.

Therefore, Applicants respectfully submits that in view of the amendment of claim 1 and the arguments presented, claims 1 and 7 are not unpatentable under 35 U.S.C. § 103(a) over Furuya et al. in view of Kyusho and Leland et al.

Accordingly, Applicants respectfully request the Examiner to withdraw the rejection to claims 1-7 under 35 U.S.C. § 103(a).

The Examiner has rejected claim 2 under 35 U.S.C. § 103(a) as being allegedly unpatentable over Furuya et al. (U.S. Patent No. 5,293,390) in view of Kyusho (U.S. Patent No. 4,802,185) and Leland et al. (U.S. Patent No. 4,264,868) as applied to claim 1 above, and further in view of Kosugi et al. (U.S. Patent No. 5,271,026).

The Examiner contends that although Furuya et al. is silent as to having a single high voltage d-c source, it is well known in the art using DC high voltage power supplies for gas lasers, as described by Kosugi et al.

Therefore, the Examiner asserts, it would have been obvious to a person skilled in the art at the time of the invention to provide the laser device of Furuya et al. with a DC power supply as disclosed by Kosugi et al. because it will provide high

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voltage electric energy.

Applicants respectfully traverse the Examiner by submitting that since the cited prior art does not teach each limitation of amended claim 1, the rejection becomes improper because the skilled artisan would not be able to combine Furuya et al., Kyusho, Leland et al., and Kosugi et al to practice the present invention.

Therefore, Applicants respectfully submit that claim 2 is not unpatentable under 35 U.S.C. § 103(a) over Furuya et al., Kyusho, Leland et al., and Kosugi.

Accordingly, Applicants respectfully request the Examiner to withdraw the rejection to claim 2 under 35 U.S.C. § 103(a).

The Examiner has rejected claim 8 under 35 U.S.C. § 103(a) as being allegedly unpatentable over Furuya et al. (U.S. Patent No. 5,293,390) in view of Kyusho (U.S. Patent No. 4,802,185) and Cirkel et al. (U.S. Patent No. 4,365,337), and Leland et al. (U.S. Patent No. 4,264,868) as applied to claim 1 above, and further in view of Taylor et al (U.S. Patent No. 5,309,462).

The Examiner alleges that although Furuya et al. is silent as to the geometry of the electrode pins, Taylor et al. describes a circuit for an electric discharge gas laser having preionization electrodes and main electrodes.

Therefore, the Examiner asserts that it would have been obvious to a person of ordinary skill in the art at the time of the invention to provide the laser device of Furuya et al. with the cylindrical planar preionization electrodes because either shape or geometry of the electrode will provide preionization of the laser gas.

Furthermore, the Examiner alleges that in the instant application the geometry or shape of the electrodes is considered a design preference.

Applicants respectfully traverse the Examiner by submitting that since the cited prior art does not teach each limitation of amended claim 1, the rejection becomes improper because the skilled artisan would not be able to combine Furuya et al., Kyusho, Cirkel et al, Leland et al., and Taylor et al. to practice the present invention.

Therefore, Applicants respectfully submit that claim 8 is not unpatentable under 35 U.S.C. § 103(a) over Furuya et al., Kyusho, Cirkel et al, Leland et al., and Taylor et al.

Accordingly, Applicants respectfully request the Examiner to withdraw the rejection to claim 8 under 35 U.S.C. § 103(a).

The Examiner has rejected claim 9 under 35 U.S.C. § 103(a)

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as being allegedly unpatentable over Furuya et al. (U.S. Patent No. 5,293,390) in view of Kyusho (U.S. Patent No. 4,802,185), Cirkel et al. (U.S. Patent No. 4,365,337) and Leland et al. (U.S. Patent 4,264,868) as applied to claim 1 above, and further in view of Bragin et al. (U.S. Patent No 6,546,036).

The Examiner alleges that although Furuya et al. is silent as to one of said pair electrodes being semi transparent, Bragin et al. illustrates a gas laser device having a pair of electrodes and where electrode includes a slit/window/opening through which UV radiation of corona discharge may pass.

Therefore, the Examiner asserts that it would have been obvious to a person of ordinary skill in the art at the time of the invention to combine the semi transparent electrode as taught by Bragin et al. to the laser device of Furuya et al. because it would prevent charged particles emanating from the main discharge area from settling on the housing and causing field distortion and discharge instabilities.

Applicants respectfully traverse the Examiner by submitting that since the cited prior art does not teach each limitation of amended claim 1, the rejection becomes improper because the skilled artisan would not be able to combine Furuya et al., Kyusho, Cirkel et al, Leland et al., and Bragin et al. to practice the present invention.

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Therefore, Applicants respectfully submit that claim 9 is not unpatentable under 35 U.S.C. § 103(a) over Furuya et al., Kyusho, Cirkel et al, Leland et al., and Bragin et al.

Accordingly, Applicants respectfully request the Examiner to withdraw the rejection to claim 9 under 35 U.S.C. § 103(a).

The Examiner has rejected claim 11 under 35 U.S.C. § 103(a) as being allegedly unpatentable over Furuya et al. (U.S. Patent No. 5,293,390) in view of Kyusho (U.S. Patent No. 4,802,185), Cirkel et al. (U.S. Patent No. 4,365,337) and Leland et al. (U.S. Patent 4,264,868) as applied to claim 1 above, and further in view of Altman (U.S. Patent No 4,847,853).

The Examiner alleges that although Furuya et al. is silent as to the inter-electrode volume being selected from 1 cm<sup>3</sup> to 200 cm<sup>3</sup>, Altman discloses typical dimensions for a TEA CO<sub>2</sub> laser having a lasant volume within the main discharge compartment of approximately 65 ml (65cm<sup>3</sup>).

Therefore, the Examiner asserts that it would have been obvious to a person of ordinary skill in the art at the time of the invention to provide the laser device of Furuya et al. with the lasant gas volume disclosed by Altman because the lasant gas volume is a typical well-known dimension for TEA lasers to provide laser beam generation.

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Applicants respectfully traverse the Examiner by submitting that since the cited prior art does not teach each limitation of amended claim 1, the rejection becomes improper because the skilled artisan would not be able to combine Furuya et al., Kyusho, Cirkel et al, Leland et al., and Altman to practice the present invention.

Therefore, Applicants respectfully submit that claim 11 is not unpatentable under 35 U.S.C. § 103(a) over Furuya et al., Kyusho, Cirkel et al, Leland et al., and Altman.

Accordingly, Applicants respectfully request the Examiner to withdraw the rejection to claim 11 under 35 U.S.C. § 103(a).

**Allowable Subject Matter**

The Examiner has indicated that claims 3-6 and 10 are free of prior art and that these claims would be allowable if rewritten in independent form.

In response, Applicants have amended claim 1 by incorporation the subject matter of claim 3. Accordingly claim 3 has been cancelled.

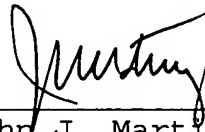
Applicants believe that all the claims are now allowable. Favorable consideration and early issuance of the Notice of Allowance are respectfully requested. Should further issues

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remain prior to allowance, the Examiner is respectfully requested to contact the undersigned at the indicated telephone number.

Respectfully submitted,



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Date: **April 5, 2005**

**Enclosures:** Copy of Oath/Declaration.



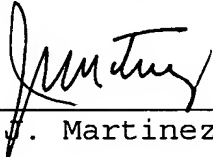
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CERTIFICATION OF MAILING AND AUTHORIZATION TO CHARGE

I hereby certify that a copy of the foregoing AMENDMENT A for U.S. Application No.: 10/612,848 filed July 3, 2003, with an attached copy of the Oath/Declaration (2 sheets), was deposited in first class U.S. mail, with sufficient postage, addressed: Mail Stop Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on **April 5, 2005**.

The Commissioner is hereby authorized to charge any additional fees, which may be required at any time during the prosecution of this application without specific authorization, or credit any overpayment, to Deposit Account No. 16-0877.

  
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John J. Martinez